

Full Length Research Paper

An Empirical Evaluation of the Role of Information and Communication Technology in Teaching and Learning Education

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ABSTRACT: This paper reports an investigation into the role of Information and Communication Technology (ICT) in promoting efficiency in teaching, using Kano University of science and technology Wudil, Kano state Nigeria as a case study. Research questions and hypotheses were developed and used as a guide in the study. Data were collected with the use of questionnaire. T-test was used in testing the hypotheses proposed for the study. The results from the sample survey of fifty (50) lecturers show that information and

communication technology plays a vital role in promoting efficiency in the teaching process. The t-test analysis shows no significant difference between the opinions of Male and Female lecturers for most items that were considered in the course of the study.

Keywords: Information communication technology, teaching, learning, efficiency, Likert scale, t-test

INTRODUCTION

There is no doubt that Information and Communication Technology (ICT) has a profound effect on the way people live. Contemporary methods of e-commerce, provision of services including learning and teaching, banking, entertainment and many others are becoming progressively dependent on ICT. In the work of Tony, (Tenth edition), (2001), efficiency was defined as the state or quality of being efficient. Furthermore, efficiency can also be an adjective that means working productively with minimum wasted effort or expense. Therefore, it could be gathered that 'efficiency' is the state or quality of working productively with minimum wasted effort or expense. Expounding the words 'expense' and 'effort' in

relation to ICT, 'expense' can be viewed in terms of cost, productivity and time whereas 'effort' could be viewed in terms of providing seminars or workshops, training and technical support. This paper seeks to examine how ICT has enhanced productivity in teaching with minimal wastage of effort (technical support, training, workshops/seminars) or expense (time, cost and productivity) in Kano University of Science and Technology Wudil, (KUST Wudil), Kano State, Nigeria.

The notion as perceived by most people that ICT is only about computers is not entirely true, but it involves computer accessories like speakers, projectors, printers, modems, networks, electronics, routers, just to mention a

few. Nweze (2010) is of the opinion that “Information and Communication Technologies have introduced new method of teaching and conducting research and have brought into education, facilities for online learning, teaching and research collaboration”. This can be seen in KUST Wudil. The universities have embraced the use of ICT in order to improve teaching and learning.”

A study by Adeoye et al. (2013) stated that the presence of “ICT in education is evident, but the impact has not been as extensive as in other fields of endeavor. The moving of the world to digital media and information has made the role of ICT in education to become more important, and this importance will continue to grow and develop in the 21st century.” Two vital components required especially in education for the advancement of teaching and learning are Information and Communication.

Timely and accurate information is essential in teaching because, latest developments in various fields of study could be the key between being progressive or regressive. As an illustration, a lecturer that is up-to-date with the current trends in his field of specialization could be a vital link in passing to his student timely and current information, thereby making them as current as their colleagues in the developed countries of the world. Communication on the other hand if not effective could be a stumbling block for current information to be passed on or even understood between the lecturer and his students, hence the need for an efficient and effective medium of communication if at all teaching itself must be effective and efficient.

However, though both government and the university management are doing a lot to enhance highly rated standards in teaching by creating commensurate educational policies, there are a lot of difficulties still facing Nigerian universities. To overcome some of these challenges, ICT facilities were put in place in these institutions. Regardless of this, there are misgivings as to whether these universities have appreciated the role of ICT in promoting efficiency in teaching or whether the lecturers particularly recognize the role of ICT and its facilities in enhancing efficiency in teaching. This premise forms the basis of this study.

Research questions

The general aim of the study is to determine the role of ICT in promoting effectiveness in teaching in the University system. The intent of the research is to investigate how ICT in teaching is perceived, how ICT in teaching has been hampered and ascertain if the availability of ICT tools has enhanced teaching and determine the level of awareness of the use of ICT facilities by instructors. Consequently the following research questions were raised to guide this study:

- (i) How do you think ICT is being perceived?
- (ii) What is the greatest hindrance(s) of ICT in teaching?
- (iii) To what extent is the availability of ICT tools relevant to teaching?
- (iv) What is the level of ICT awareness in KUST Wudil?

Research Hypothesis

Ho1: There is no significant difference between the mean ratings of male and female lecturers with regards to the role of ICT facilities in promoting efficiency in teaching in KUST Wudil.

The importance and contribution of ICT in teaching is highlighted so that educational policy makers can appreciate the advantages derived from the use of ICT in teaching. This study will contribute vastly in creating awareness among lecturers of the use of ICT in teaching. This will also bring to the attention of lecturers the vast resources that are available to them when using ICT in teaching. The rest of the paper is structured as follows: Section 2 presents a survey of the related work that motivates this paper. Section 3 describes in detail the materials and methods used in the paper and Section 4 analyses the results obtained. Finally, we present our conclusions in Section 5.

LITERATURE REVIEW

The work of McLeod (2015) highlighted a study anchored on Skinner theory (Operant Conditioning) which states that “an individual learns better if the environment is controlled by reinforcing stimulus that will strengthen behavior such as readiness to learn and teaching styles”. The theory emphasized the need for educators (lecturers) to enhance teaching activities through cautious manipulation of technologies with the learners as active participants; hence stressing the need for educators to organize teaching experiences and allow learning to take place by providing adequate learning resources required in this global age.

Information and Communication Technology has opened a new visage to globalization according to Aguele, (2007). He added that the deployment and integration of ICT facilities in universities for internet access and web portal implementation that enable the university to carry out most of its activities ubiquitously on the internet is steadily growing in developing nations.

Researchers have been using the phrase “Information and Communication technology” as far back as the 1980s (Melody et al., 1986). Adebayo (2008) stated clearly that “ICT is a broad term that has to do with the harnessing of process, the product of electronic and communication,

related technologies and other related resources in today's knowledge driven society, for enhancing the productivity, the spread and the efficiency of a set of programmed activities geared towards the achievement of clearly determined goals". The National Policy on Information Technology (2001) defined IT as "computer auxiliary equipment software and firmware, procedures, services and related resources". The document described ICT as any equipment or interconnected system of equipment that is used in the automatic acquisition, storage, manipulation management, control, display, and switching and transmission of information.

In Vajargah et al. (2010), obstacles, facilitators and risk of using ICT in teaching and learning in higher education were discussed. The authors sort to discover what fields and to what extent are there obstacles, facilitators and the risk in using ICT in teaching and learning.

Spiegel and Stephens, (2011) asserted that "ICT has a significant impact on educational practices in Nigeria and that such impact would grow considerably in coming years". Six (6) randomly selected tertiary institutions in South Eastern Nigeria were considered of which two (2) were universities, two (2) Polytechnics and two (2) were Colleges of Education. They also carried out a test-retest method to determine the reliability of the instrument used in the study. In a research survey conducted by Ezeani and Akpotohwo, (2014), they discovered that the universities offering Accounting Education courses in Ekiti State held in high esteem the role of ICT facilities in discharging their academic duties. Another study conducted at the Federal University of Technology Yola, Adamawa State, Nigeria by Oye et al. (2012) was aimed at finding out the correlation between students and the use of ICT in their studies. Questionnaires were administered to first year students offering MA112 and the result indicated a significant correlation between the students and the use of ICT in their academic work. It also depicts a negative attitude by students towards using ICT in their academic work. They recommended that the government develop ICT policies and guidelines to support all levels of education from primary school up to the university level. The concepts of quality assurance and ICT and the role expected of ICT facilities in enhancing university quality assurance procedures was examined in the work of Major, (2013). His finding was that ICT facilities can enhance the quality assurance procedures used in Nigerian universities. He also showed the need to use ICT to ensure that basic quality assurance procedures are adopted and maintained in Nigerian universities in line with the prescribed minimum standard.

MATERIALS AND METHODS

The research design for this study is a descriptive survey.

The population of this study is made up of 50 lecturers of the KUST Wudil consisting of both males and females. This covered every faculty (6 in total) of the university. The stratified random sampling technique was adopted because the targeted population is made up of two subgroups (strata) i.e. male and female groups of lecturers. Out of the 50 questionnaires that were distributed to the lecturers, 46 were returned and were used as sample for the study. Three sources of data which include: the primary sources, the secondary sources and the tertiary sources were used. Primary sources provided the 'raw data' that was used to test the working hypothesis and also served as evidence to support the findings. The primary source adopted is the questionnaire.

Secondary sources include research reports related to this study that use primary data to solve research problems. The tertiary sources are the textbooks, articles in encyclopedia, mass publications and data obtained from search engines like Google. The questionnaire was structured such that it contained 26 items out of which 6 items were demographic in nature. The remaining 20 items were structured such that the lecturers being issued with the questionnaires would rate each question based on the Likert scale of 1-5 with (1) representing "Strongly Disagree", (2) representing "Disagree", (3) representing "Neither Agree nor Disagree", (4) representing "Agree", and (5) representing "Strongly Agree". In order to arrive at the result obtained for this study, the items in the questionnaire were based on the research questions. This was so done in order to solicit for information from the lecturers with regards to their use, awareness and problems encountered in relation to ICT in KUST Wudil.

Research procedure

The following procedures/methods were used in carrying out this study; Questionnaires were first distributed to the lecturers and data required for this study were collected consequently at a later date for analysis. The mean for each item collected as data was obtained based on the Likert scale ratings used in the questionnaires of the study. This gives the general view of the opinion of the lecturers as a whole. The standard deviation of the data is then calculated. The T-test was also conducted to test the hypothesis on which the study is based, using a level of significance of 0.05 (5%). The results are presented in tables and commented upon. Inferences are derived from the tables presented. Conclusions and recommendations are made with regards to the work carried out.

Data analysis techniques

Various data analysis techniques like Mean, Standard

Table1: Demographic Information.

Measure	Items	Frequency	Percentage
Gender	Male	32	69.57
	Female	14	30.43
Age	19-25	0	0
	26-35	26	56.52
	36 and above	20	43.48
Use of ICT	Mandatory	44	95.65
	Optional	2	4.35
Frequency of ICT Usage	Once or more a day	41	89.13
	Once a week	5	10.87
	Twice a month	0	0.00
	Once a month	0	0.00
	Never	0	0.00
Lecturer's Rank	Professor	4	8.70
	Assoc. Professor	4	8.70
	Senior Lecturer	6	13.04
	Lecturer I	8	17.40
	Lecturer II	10	21.74
	Assistant Lecturer	10	21.74
Barrier to ICT Usage	Graduate Assistant	4	8.70
	Cost	20	43.48
	Technical Support	15	32.61
	Training	11	23.91

Deviation and T-test Analysis were used in this study. Similar techniques were used in the work presented in Spiegel and Stephen, (2011), Frank and Althoen, (1995) and Saratu et al., 2016).

RESULTS AND DISCUSSION

Table 1 presents the demographic information about the respondents who took part in the survey. Further analysis and results obtained from this study are as presented in (Tables 2– 7). Table 2 shows the responses of lecturers with a majority of them agreeing to their interest in using ICT in teaching and also that it has made teaching easier. These attracted the highest mean scores of 4.1087 and 4.1739 respectively. Their respective standard deviations (S.D) are 0.9143 and 1.0489. Their opinion on whether ICT was invented for teaching attracted a Mean of 3.8043 and a S.D of 0.9695. Table 3 shows the responses of lecturers' perception on the use of ICT in teaching. Their opinion on ICT as an important part of teaching has a mean rating of 4.1087, the importance of training/workshops attracted a mean rating of 4.0870 and on whether ICTs (ICT and its tools) aid lecturers in teaching, they agreed with a mean rating of 4.1739. Their respective S.D is 0.9143, 1.0597 and 0.9624. The least mean score of 3.1304 was associated with lecturers' opinion on whether most people think that ICT is limited to computers and the Internet. This attracted a Mean of 3.1304 and a S.D of 1.1907. As indicated in (Table 4), of

the greatest hindrance facing ICT "limited Internet connectivity" attracted the highest mean rating of 4.286 and having a S.D of 1.0767. Computer unavailability, electric power supply problem, lecture hall factor and lecturer factor have a Mean of 3.8696, 3.8478, 3.6304 and 3.2826 respectively. These items had S.D of 1.1907, 1.2678, 1.0078 and 1.1473 respectively. Table 5 shows the response of the lecturers. Computer knowledge and Absence of ICT tools in relation to teaching each attracted the highest Mean rating of 4.3043 but with different S.D of 1.0605 and 1.0187 respectively. Availability of Learning Management System (LMS) portal and Availability of ICT tools with regards to development of ICT infrastructure attracted mean ratings of 3.8478 and 4.0435 respectively. They had S.D of 1.0828 and 0.9315 respectively. Table 6 clearly indicates that the least Mean rating response of the lecturers which is associated with the Existing Method of Teaching is 2.6304 while it's S.D 1.0078. The issue of "lecturers being well informed of ICTs", the "need to improve awareness of ICTs" and "creating awareness of ICT" attracted a Mean of 3.2609, 4.3478 and 4.3261 respectively. These items have S.D of 1.0689, 0.7288 and 0.8013 respectively. Table 7 shows a critical value of 1.68 at a 0.05 level of significance, and the degree of freedom 44, while considering the 20 items in the questionnaire from top to bottom. There is no significant difference between male and female lecturers opinion on interest in ICT usage in teaching (*T-Cal.* = -0.2455). There is no significant difference between male and female lecturers opinion on issues of ICT and its

Table 2: Mean rating of opinion of lecturers about ICT being applied in teaching

ICT in Teaching	MEAN	S.D
Lecturers are interested to use ICT in teaching	4.1087	0.9143
ICTs have made teaching easier	4.1739	1.0489
ICTs is invented to enhance teaching	3.8043	0.9695

Table 3. Mean rating of how the use of ICT is being perceived by lecturers

Use of ICT in Teaching	MEAN	S.D
ICTs is an important part of teaching	4.1087	0.9143
Lecturer training/workshop is important, apart from using ICT in teaching	4.0870	1.0597
ICTs aid Lecturers in teaching	4.1739	0.9624
Most people think that ICTs is limited to computers and Internet	3.1304	1.1907

Table 4. Lecturers' view on what the greatest hindrances of ICT in teaching are.

Difficulties Facing ICT's Usage	Mean	S.D
Lecturer factor	3.2826	1.1473
Lecture Hall factor	3.6304	1.0078
Electric power supply problem	3.8478	1.2678
Limited Internet connectivity	4.2826	1.0767
Computer unavailability	3.8696	1.1907

Table 5. Mean response of lecturers on the availability of ICT tools/skills relevant to teaching

Availability of ICT tools	MEANS.D
Lecturers with computer knowledge enhance the use of ICTs in teaching	4.30431.0605
Availability of KUST Wudil LMS portal make teaching effective	3.84781.0828
The availability of ICT tools will ensure the development of ICT infrastructure	4.04350.9315
Absence of ICT tools affects the use of ICTs in teaching	4.30431.0187

Table 6. Mean response of lecturers on the level of ICT awareness in KUST Wudil

ICTs Awareness	MEANS.D
Lecturers are well aware of ICTs	3.26091.0689
There is still need to improve the awareness of ICTs among Lecturers	4.34780.7288
Existing methods of teaching are enough to support ICTs	2.63041.0078
KUST Wudil is trying to create awareness about the importance of using ICTs in education	4.32610.8013

facilities making teaching easier ($T-Cal. = -0.2995$). There exist a significant difference between male and female lecturers opinion on issues of ICT and its facilities being invented to enhance teaching ($T-Cal. = 3.1681$). There is no significant difference between male and female lecturers opinion on issues of ICT and its facilities as important part of teaching ($T-Cal. = 0.8128$). There is no significant difference between male and female lecturers opinion on issues of training/workshops being important apart from ICT in teaching ($T-Cal. = 0.3281$). There is no significant difference between male and female lecturers opinion on issues of ICT and its facilities aiding lecturers

in teaching ($T-Cal. = 0.7167$). There exist a significant difference between male and female lecturers opinion on issue that most people think that ICT is limited to computers and internet ($T-Cal. = 2.3913$). There is no significant difference between male and female lecturers opinion on issue of lecturers factor being a hindrance to the usage of ICT and its facilities ($T-Cal. = -3.5880$). There is no significant difference between male and female lecturers opinion on issue of lecture Hall being one of the hindrance to the usage of ICT and its facilities ($T-Cal. = -2.2344$). There is no significant difference between male and female lecturers opinion on issue of electricity power

Table 7: t-test analysis of the response of Male and Female Lecturers on the role of ICT facilities in promoting efficiency in teaching.

Gender	NUMBER	MEAN	S.D	D.F	T.CALCULATE	T-CRITICAL	REMARK
Male	34	4.0882	0.8529	44	-0.2455	1.68	Accepted
Female	12	4.1667	1.0672				
Male	34	4.1471	1.0328	44	-0.2995	1.68	Accepted
Female	12	4.2500	1.0897				
Male	34	4.0588	0.7253	44	3.1681	1.68	Rejected
Female	12	3.0833	1.1873				
Male	34	4.1765	0.8902	44	0.8128	1.68	Accepted
Female	12	3.9167	0.9536				
Male	34	4.1176	1.0783	44	0.3281	1.68	Accepted
Female	12	4.0000	1.3229				
Male	34	4.2353	0.9412	44	0.7167	1.68	Accepted
Female	12	4.0000	1.0000				
Male	34	3.3529	1.1853	44	2.3913	1.68	Rejected
Female	12	2.5000	0.9574				
Male	34	2.9706	1.1899	44	-3.5880	1.68	Accepted
Female	12	4.1667	0.3727				
Male	34	3.4412	1.0625	44	-2.2344	1.68	Accepted
Female	12	4.1667	0.5528				
Male	34	3.7353	1.2904	44	-1.1475	1.68	Accepted
Female	12	4.1667	1.1426				
Male	34	4.4118	0.8844	44	1.5350	1.68	Accepted
Female	12	3.9167	1.0375				
Male	34	3.9118	1.2216	44	0.4420	1.68	Accepted
Female	12	3.7500	1.0897				
Male	34	4.3824	0.9398	44	0.8756	1.68	Accepted
Female	12	4.0833	1.3202				
Male	34	3.8235	1.0131	44	-0.2679	1.68	Accepted
Female	12	3.9167	1.2555				
Male	34	4.2647	0.8879	44	2.6387	1.68	Rejected
Female	12	3.4167	1.0004				
Male	34	4.3824	0.9496	44	0.8948	1.68	Accepted
Female	12	4.0833	1.1149				
Male	34	3.5882	1.1406	44	3.6165	1.68	Rejected
Female	12	2.3333	0.8498				
Male	34	4.4706	0.5579	44	1.6957	1.68	Rejected
Female	12	4.0000	1.0000				
Male	34	2.9118	0.9812	44	3.4356	1.68	Rejected
Female	12	1.8333	0.5528				
Male	34	4.3529	0.7011	44	0.3472	1.68	Accepted
Female	12	4.2500	1.0129				

supply being one of the hindrance to the usage of ICT and its facilities ($T-Cal. = -1.1475$). There is no significant difference between male and female lecturers opinion on issue of limited internet connectivity being one of the hindrance to the usage of ICT and its facilities ($T-Cal. = 1.5350$). There is no significant difference between male and female lecturers opinion on issue of computer unavailability being one of the hindrance to the usage of ICT and its facilities ($T-Cal. = 0.4420$). There is no significant difference between male and female lecturers opinion on issue of lecturers equipped with computer knowledge would enhance the use of ICT and its facilities in teaching ($T-Cal. = 0.8756$). There is no significant difference between male and female lecturers opinion on

issue of availability of KUST Wudil LMS portal making teaching effective ($T-Cal. = -0.2679$). There exist a significant difference between the opinion of male lecturers and female lecturers with regard to the issue of the availability of ICT tools ensuring the development of ICT infrastructure ($T-Cal. = 2.6387$). There is no significant difference between male and female lecturers opinion on issue of the absence of ICT tools affecting the use of ICT and its facilities in teaching ($T-Cal. = 0.8948$). There exist a significant difference between the opinion of male lecturers and female lecturers with regard to the issue of lecturers being well aware of ICT and its facilities ($T-Cal. = 3.6165$). There exist a significant difference between the opinion of male lecturers and female

lecturers with regard to the issue of the need to improve the level of awareness of ICT and its facilities ($T\text{-Cal.} = 1.6957$). There exist a significant difference between the opinion of male lecturers and female lecturers with regard to the issue of existing methods of teaching are enough to support ICT and its facilities ($T\text{-Cal.} = 3.4356$). There is no significant difference between male and female lecturers opinion on issue of KUST Wudil trying in its effort to create awareness about the importance of using ICT and its facilities in education ($T\text{-Cal.} = 0.3472$).

Conclusion

The results obtained from the data analysis indicate that the respondents acknowledged the role that ICT facilities play in promoting efficiency in teaching. They consequently outlined among other roles their usage of ICT in teaching. They consensually agreed to the fact that using ICT in teaching is in the interest of lecturers since it makes teaching easier. On their opinion on whether ICTs were invented to enhance teaching, the mean of their opinions seems to tend towards an agreement of opinion but with most of them neither agreeing nor disagreeing to the item (Mean = 3.8043 and S.D = 0.9695). They also agreed that ICT and its facilities/tools were an important part of teaching and that it can aid lecturers in teaching. They also agreed that training/workshops organized for lecturers are quite important so as to help them in the use of ICT and its facilities. However, their opinion on whether most people think ICT and its facilities are limited to computers and Internet shows that they seem to neither agree nor disagree (Mean = 3.1304 and S.D = 1.1907). The result also outlined the difficulties faced in the use of ICT and its facilities with greater emphasis on the limitation of Internet connectivity. Other difficulties include: limited computers and their accessories, limited electric power supply and limited number of lecture halls. However, the result indicate that they seem to neither agree nor disagree that the lecturer factor contributes to the difficulty facing ICT's usage (Mean = 3.2826 and S.D = 1.1413). Concerning the availability of ICT tools/skills, the result shows that there is consensus among lecturers opinion that lecturers with computer knowledge enhance the use of ICTs in teaching. It also shows that the availability of the University LMS Portal and other ICT tools will ensure effectiveness in teaching and the development of ICT infrastructure. The result also indicates that the absence of these would affect the use of ICT and its facilities in teaching. The result on the awareness of ICT and its facilities shows that the response of the lecturers is indicative that they neither agree nor disagree with the fact related to lecturers being well informed of ICTs (Mean = 3.2609 and S.D = 1.0689) but seem to agree with the issue of the need to improve

awareness of ICT (and its facilities) among lecturers and that the university is doing its best to create awareness about the importance of using ICT and its facilities in teaching. However, there was a consensus disagreement to the fact the existing methods of teaching are enough to support ICTs (Mean = 2.6304 and S.D = 1.0078). The result of the T-test on the null hypothesis showed that the null hypothesis was upheld for fourteen (14) out of the twenty (20) items, since they have their value of T-Calculate less than the T-Critical which is at 0.05 level of significance and a degree of 44. However, the null hypothesis for the remaining items was upheld (about 70%). We therefore claim that the opinion of male and female lecturers of KUST Wudil does not differ significantly with regards to the role of ICT in promoting efficiency in teaching in the university.

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